

# Chapter 3

## OPERATION USING "TP-A1-LM2"

This chapter describes how to operate FRENIC-Lift (LM2) using with optional multi-function keypad "TP-A1-LM2".

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### 3.1 LCD monitor, keys and LED indicators on the keypad

The keypad "TP-A1-LM2" allows you to run and stop the motor, monitor the running status, specify the function code data, and monitor I/O signal states, maintenance information, and alarm information.

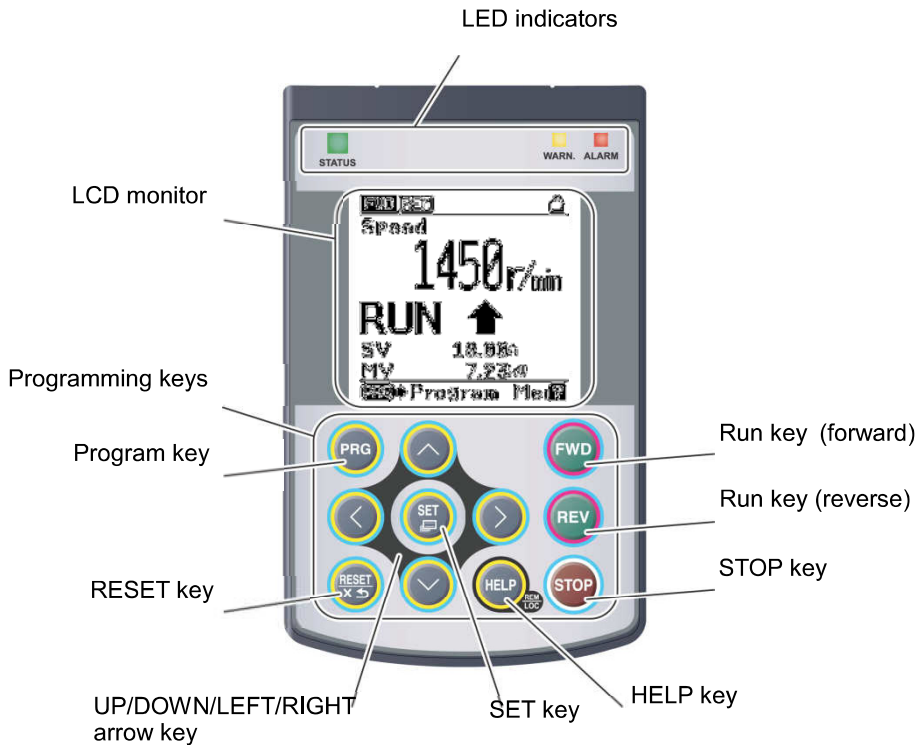


Figure 3.1 Names and Functions of Keypad Components

LED indicators:	These indicators show the current running status of the inverter.	Refer to Table 3.1.
LCD monitor:	This monitor shows the following various information about the inverter according to the operation modes.	Refer to Figure 3.2 and Table 3.3 and Table 3.4.
Keys:	These keys are used to perform various inverter operations.	Refer to Table 3.2.

Table 3.1 Indication of LED Indicators














LED Indicators	Indication	
 STATUS (Green)	Shows the inverter running state.	
	Flashing	No run command input (Inverter stopped)
 WARN. (Yellow)	ON	Run command input
	Shows the warning state (light alarm).	
 ALARM (Red)	OFF	No light alarm has occurred.
	Flashing /ON	A light alarm has occurred. <b>But inverter can continue running.</b>
 ALARM (Red)	Shows the alarm state (heavy alarm).	
	OFF	No heavy alarm has occurred.
Flashing	A heavy alarm has occurred. <b>Inverter shuts off its output.</b>	

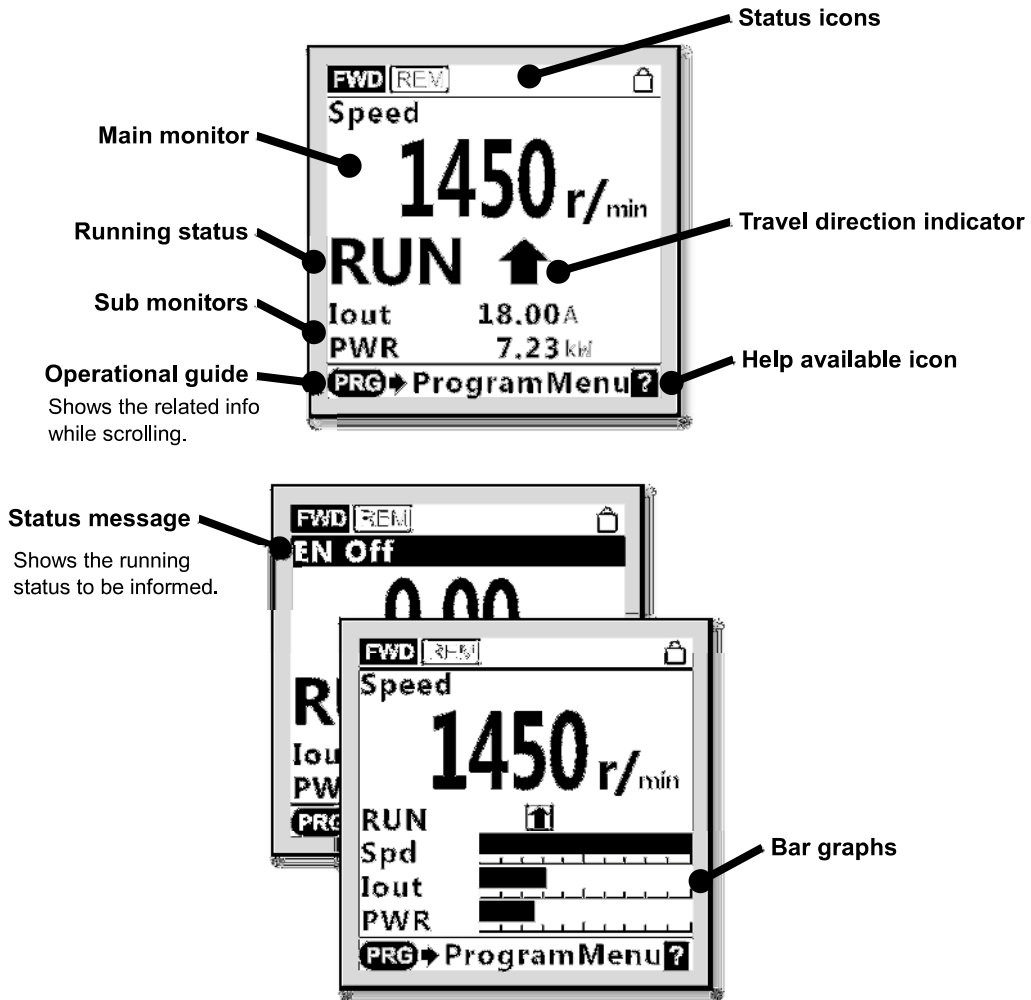
Table 3.2 Overview of Keypad Functions

Keys	Functions
	This key switches the operation modes between Running mode/Alarm mode and Programming mode.
	Reset key which works as follows according to the operation modes. <ul style="list-style-type: none"> <li>■ In Running mode: This key cancels the screen transition.</li> <li>■ In Programming mode: This key discards the settings being configured and cancels the screen transition.</li> <li>■ In Alarm mode: This key resets the alarm states and switches to Programming mode.</li> </ul>
	UP/DOWN key which works as follows according to the operation modes. <ul style="list-style-type: none"> <li>■ In Running mode: These keys switch to the digital reference speed (when local mode).</li> <li>■ In Programming mode: These keys select menu items, change data, and scroll the screen.</li> <li>■ In Alarm mode: These keys display multiple alarms and alarm history.</li> </ul>
	These keys move the cursor to the digit of data to be modified, shift the setting item, and switch the screen.
	Set key which works as follows according to the operation modes. <ul style="list-style-type: none"> <li>■ In Running mode: Pressing this key switches to the selection screen of the LCD monitor content.</li> <li>■ In Programming mode: Pressing this key established the selected items and data being changed.</li> <li>■ In Alarm mode: Pressing this key switches to the alarm detailed information screen.</li> </ul>
	Pressing this key calls up the HELP screen according to the current display state. Holding it down for 2 seconds toggles between the remote and local modes.
	Pressing this key starts running the motor in the forward rotation (when local mode).
	Pressing this key starts running the motor in the reverse rotation (when local mode).
	Pressing this key stops the motor (when local mode).

■ LCD Monitor

The LCD monitor shows various information of the inverter according to the operation modes.

< Screen sample in Running mode >



< Screen sample in Alarm mode >

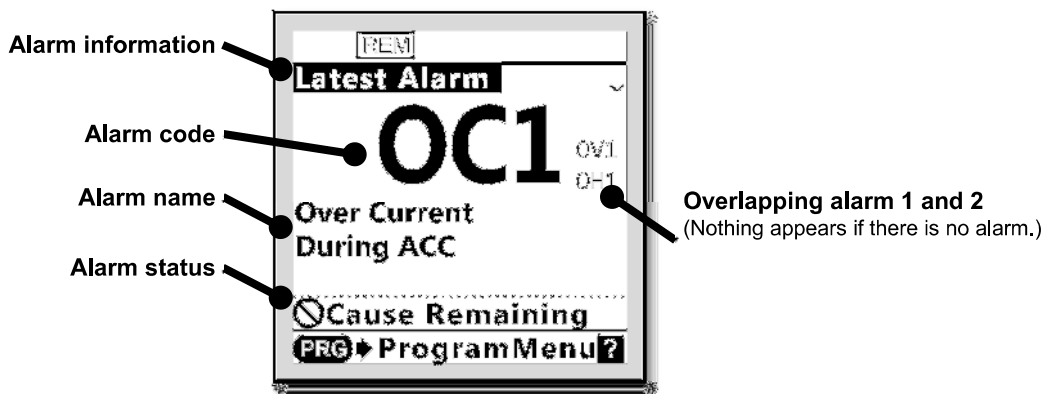


Figure 3.2 Principal displaying item on the LCD monitor

Table 3.3 Icons on the LCD Monitor













Status icons that show the running status, run command sources and various icons		
	Running status (rotation direction)	Running forward
		Running reverse
	Run command source	External terminals
		Communications link
		Keypad in local mode
	Password protection state	Locked with password 1 (Function code data change is prohibited.)
		Lock being released (Password being canceled temporarily)
	Travel direction (Appears during Programming mode and Alarm mode.)	Traveling upward
		Traveling downward
Running status		
<b>STOP</b>	Running status	No run command entered or inverter stopped
<b>RUN</b>		Run command entered or during inverter output
Travel direction indicator		
	Travel direction (Appears during Running mode.)	Traveling upward
		Traveling downward

Table 3.4 Status messages on the LCD Monitor

Status messages	Appearance condition
Low Supply Volt	Run command is turned ON at low supply voltage.
EN Off	Run command is turned ON when [EN1] and/or [EN2] are being released.
BX Active	Run command is turned ON when <b>BX</b> command is being turned ON.
AutoReset ALM	Inverter is trying / waiting to reset the alarm automatically.
Pre-Alarm	Inverter is detecting pre-alarm by overheat.
Standby	Inverter is in standby mode by means of <b>STBY</b> command.
Unlocking SG	Inverter is trying to unlock safety gear by means of <b>ULSG</b> command.
Rescue by BRKS	Inverter is releasing brakes for emergency rescue operation by means of <b>RBRK</b> command.
Battery Op.	Inverter is operating as battery mode by means of <b>BATRY</b> command.
DC-Cap. Measure	Inverter is measuring its main capacitor lifetime before turning power OFF.
L.Factor Measure	Inverter is measuring load factor of the applying system.

 **LCD** has temperature characteristics. The low temperature slows down the LCD response; the high temperature makes the screen contrast high so that contrast adjustment may be needed.

## 3.2 Overview of Operation Modes

The keypad has the following three operation modes:

- **Running mode** : After powered ON, the inverter automatically enters this mode.  
 This mode allows you to specify the reference speed, and run/stop the motor with the **FWD** / **REV** / **STOP** keys during local mode.  
 It is also possible to monitor the running status in real time.
- **Programming mode** : This mode allows you to configure function code data and check a variety of information relating to the inverter status and maintenance.
- **Alarm mode** : If an alarm condition arises, the inverter automatically enters Alarm mode. In this mode, you can view the corresponding alarm code\* and its related information on the LCD monitor.

\* Alarm code: Indicates the cause of the alarm condition.

Figure 3.3 shows the status transition of the inverter between these three operation modes. If the inverter is turned ON, it automatically enters Running mode, making it possible to start or stop the motor.

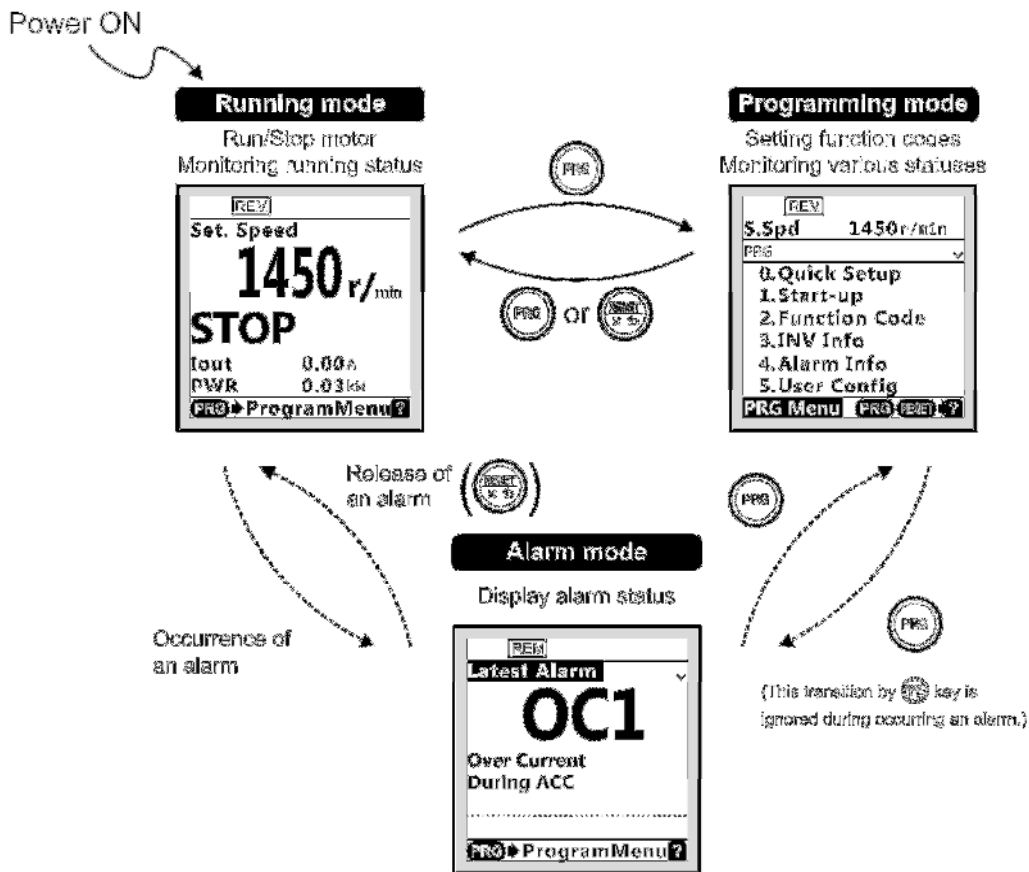


Figure 3.3 Screens Transition between each operation Modes

## 3.3 Running Mode

When the inverter is turned on, it automatically enters Running mode in which you can:

- (1) Monitor the running status (e.g., reference speed and output current),
- (2) Switch between remote and local modes,
- (3) Configure the reference speed (pre-ramp), and
- (4) Run/stop the motor.

### 3.3.1 Monitoring the running status


In Running mode, the nine items listed below can be monitored. Immediately after the inverter is turned on, the monitor item specified by function code K10 is displayed. Press the  key to switch between monitor items.

Table 3.5 Monitoring Items (Selectable anytime)

Monitor #	Monitor Items	Sub-monitor	Unit	Meaning of displayed value	Function code data for E43
0	Speed monitor	Function code E48 specifies what to be displayed on the main monitor.			0
	Reference speed (final)	Spd	*1	Reference speed (final) command to the Automatic speed regulator (ASR)	(E48 = 0)
	Reference speed (pre-ramp)	S.Spd	*1	Reference speed being set	(E48 = 2)
	Motor speed	Sync	r/min	Motor rotation speed	(E48 = 3)
	Elevator speed	Lift	m/min	Elevator speed in m/min	(E48 = 5)
	Elevator speed 2	Lift	mm/s	Elevator speed in mm/s	(E48 = 8)
13	Output current	Iout	A	Current output from the inverter in RMS	3
14	Output voltage	Vout	V	Voltage output from the inverter in RMS	4
18	Calculated torque	TRQ	%	Calculated motor output torque in % *2	8
19	Input power	PWR	kW	Input power to the inverter	9
28	Reference torque	TRQC	%	Motor output torque in %	18
29	Torque bias balance adjustment value	BTBB	%	Used to adjust the analog torque bias balance	19
30	Torque bias gain adjustment value	BTBG	%	Used to adjust the analog torque bias gain	20

\*1 Function code C21 provides a choice of speed units – Hz, r/min, m/min, and mm/s.

\*2 In vector control with PG, this item shows the reference torque.

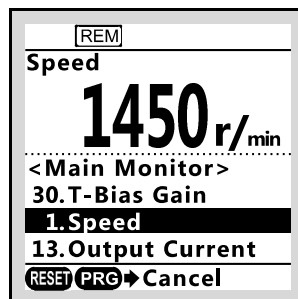



Figure 3.4 Switching main monitor item (display sample)






### 3.3.2 Remote and Local modes

The inverter is available in either remote or local mode.



In remote mode, which applies to normal operation, the inverter is driven under the control of the data setting stored in the inverter. In local mode, which applies to maintenance operation, it is separated from the control system and is driven manually under the control by the keypad.







Holding down the  key on the keypad for 2 seconds or more, toggles between remote and local modes. **Additionally, local mode is not kept after turning power on again. In other words, the inverter starts up as remote mode always.**

 The current mode can be checked by the status icons. The  is displayed in remote mode and the  is displayed in local mode.

Switching from remote to local mode automatically inherits the reference speed (pre-ramp) used in remote mode. If the motor is running at the time of the switching from remote to local, the run command will be automatically kept ON. If, however, there is a discrepancy between the settings used in remote mode and ones made on the keypad (e.g., switching from the reverse rotation in remote mode to the forward rotation only in local mode), the inverter automatically stops.

### 3.3.3 Setting up reference speed (pre-ramp)

In local mode, you can set up the desired **reference speed (pre-ramp)** in displayed units with  /  keys on the keypad.

- (1) Switch the keypad to Running mode. This is because in Programming or Alarm mode, the  /  keys are disabled to set the **reference speed (pre-ramp)**.
- (2) Press the  /  key to display the current **reference speed (pre-ramp)**. The lowest digit will blink.
- (3) To change the **reference speed (pre-ramp)**, press the  /  key again. The new setting can be saved into the inverter's internal memory.

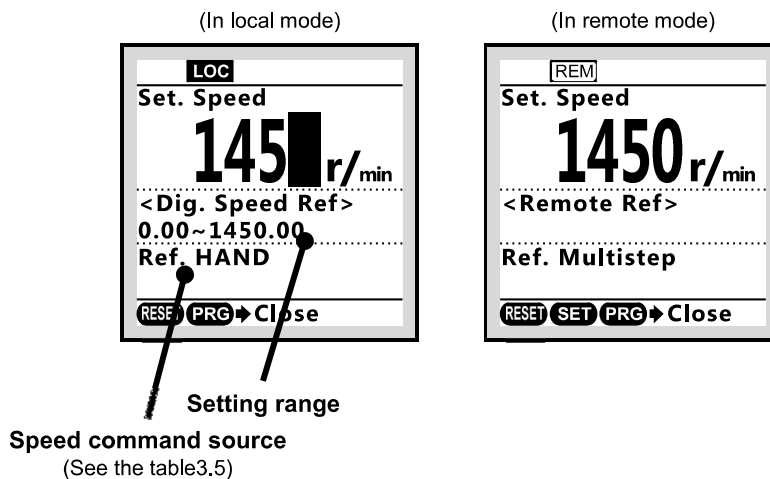


Figure 3.5 Setting up reference speed (display sample)








-  • The reference frequency will be saved either automatically by turning the main power OFF.
- When you start specifying the **reference speed (pre-ramp)** or any other parameter with the  /  key, the least significant digit on the display blinks; that is, the cursor lies in the least significant digit. Holding down the  /  key changes data in the least significant digit and generates a carry, while the cursor remains in the least significant digit.
- Using the  /  key moves the cursor (blinking) between digits, making change to the large value easily.

Table 3.6 Available Speed command sources

Symbol	Command source	Symbol	Command source
HAND	Keypad	Multistep	Multistep speed command
AnlgNR	Analog speed command (Not reversible)	Anlg_R	Analog speed command (Reversible)
RS485 Ch1	Via RS485 communications link (port 1: Keypad port)	RS485 Ch2	Via RS-485 communications link (port 2: Terminal block)
Loader	Via FRENIC Loader software	CAN	Via CAN communications link
Jogging	Jogging operation		

### 3.3.4 Running/stopping the motor

In local mode, pressing the  $\text{FWD} / \text{REV}$  key starts running the motor in the forward or reverse direction and pressing the  $\text{STOP}$  key decelerates the motor to stop. The  $\text{FWD} / \text{REV}$  key is enabled only in Running and Programming mode.

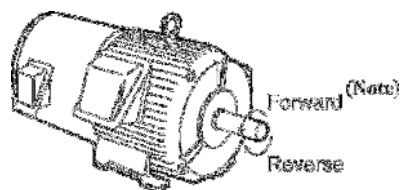


Figure 3.6 Rotational direction of motor

Note) The rotational direction of IEC-compliant motor is opposite to the one shown here.

## 3.4 Programming Mode

Programming mode allows the setting and confirmation of function codes, and monitoring of maintenance-related and input/output (I/O) terminal information, as well as other functions. A menu format is used to enable simple function selection. The menu transition for programming mode is shown below.

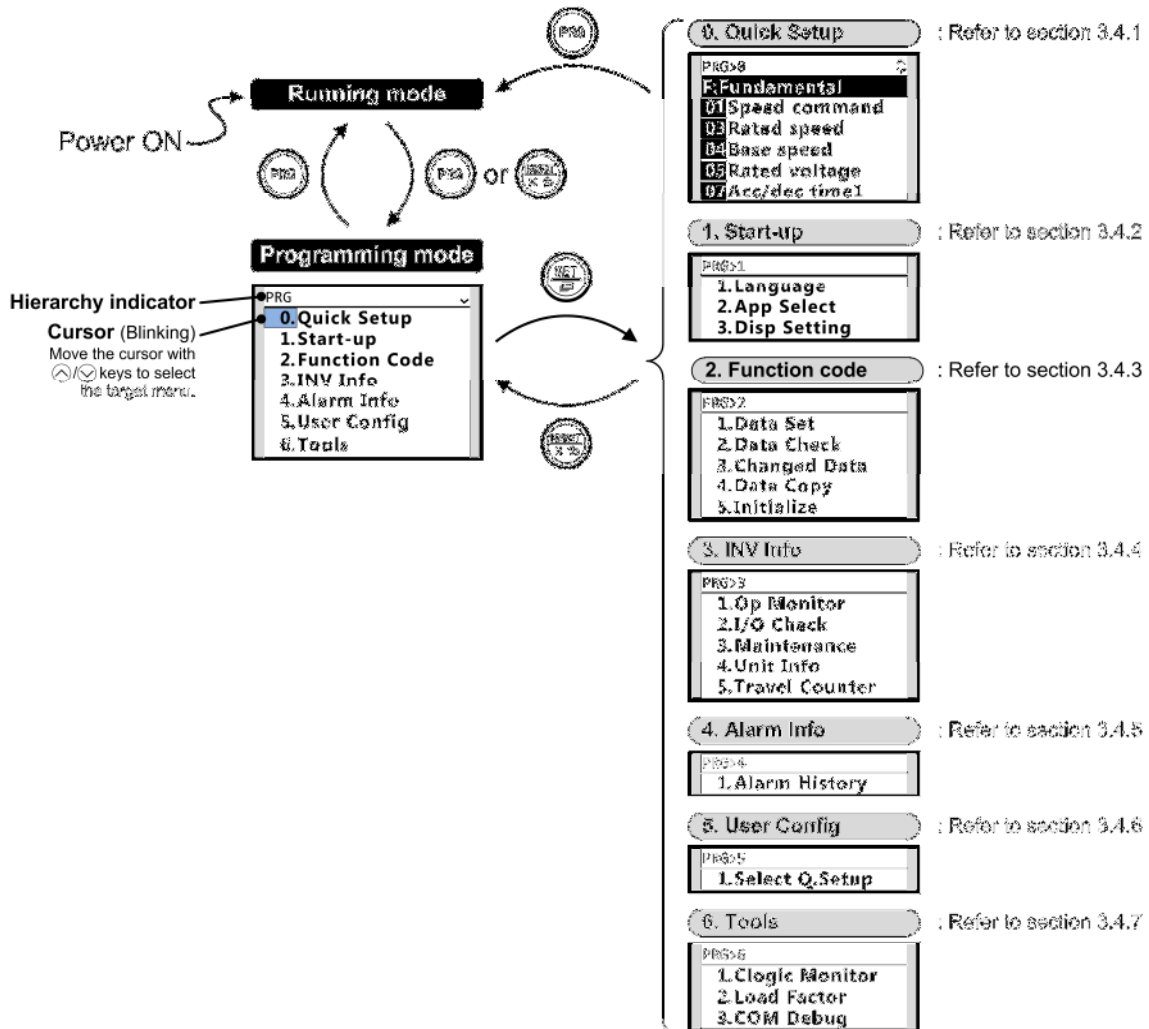


Figure 3.7 Menu transition in Programming mode

### ■ Hierarchy indicator

The hierarchical structure for each screen is indicated in order to let you know where you are. For example, if you see “Alarm history” screen, this indicator shows as **PRG>4>1**.

Additionally, this indicator might show page number, function code number, alarm code, or etc. with corresponding to each situations.

Table 3.7 Menus available in Programming mode

Main Menu	Sub-Menu	Hierarchy indicator	Principal Functions
0. Quick Setup: Shows only frequently used function codes.			
—	—	PRG>0	
1. Start-up: Sets functions for initial settings.			
1	Language	PRG>1>1	Sets language to be displayed on LCD monitor.
2	Select application	PRG>1>2	Allows individual initialization of function codes that are grouped by application.
3	Display settings	PRG>1>3	Selects content to be displayed on LCD screen.
2. Function Code: Setting screens related to function codes, such as setting/copying function code data.			
1	Set data	PRG>2>1	Allows function code data to be displayed/changed.
2	Confirm data	PRG>2>2	Allows confirmation of function code settings.
3	Confirm revised data	PRG>2>3	Allows confirmation of function code changes from factory-default settings.
4	Copy data	PRG>2>4	Reads, writes and verifies function code data between the inverter and the keypad.
5	Initialize data	PRG>2>5	Restores function code data values to factory-default settings.
3. INV Information: Allows monitoring of inverter operational status.			
1	Operation monitor	PRG>3>1	Displays operational information.
2	I/O checking	PRG>3>2	Displays external interface information.
3	Maintenance information	PRG>3>3	Displays cumulative run time and other information used during maintenance.
4	Unit information	PRG>3>4	Allows confirmation of inverter type, serial number and ROM version.
5	Travel direction counter	PRG>3>5	Allows confirmation and setting of travel direction counter. This function provides the information for replacing wire/rope.
4. Alarm Information: Displays alarm information.			
1	Alarm history	PRG>4>1	Lists alarm history (newest + 3 previous). Also this allows you to view the detail information on the running status at the time when alarm occurred.
5. User Configure: Allows any settings to be made.			
1	Quick setup selection	PRG>5>1	Allows function codes to be added to or deleted from the "Quick Setup".
6. Tools: Various functions			
1	Customizable logic monitor	PRG>6>1	Previews status of each step in customizable logic.
2	Load Factor Measurement	PRG>6>2	Allows measurement of the operational status of the maximum output current and average output current.
3	Communication Debugging	PRG>6>3	Allows monitoring and setting of function codes for communication (S, M, W, X, Z, and etc.)

### 3.4.1 Quick Setup

PRG > 0

Menu number 0, "Quick Setup" shows only those function codes predetermined to have a high usage frequency.

Menu number 5, "User Config" can be used to add or delete function codes from the Quick Setup.

### 3.4.2 Start-up

PRG > 1

Menu number 1, "Start-up" allows display of information needed on startup: the language displayed on the LCD monitor and inverter operational status.

#### 3.4.2.1 Set Display Language: "Language"

PRG > 1 > 1 > K01

Allows setting of the keypad display language (15 languages + user customizable language).

This setting is same as function code K01.


Available languages might change according to software version of TP-A1-LM2.

#### 3.4.2.2 Select application: "App Select"

PRG > 1 > 2 > H03

Allows individual initialization of function codes that are grouped by application.

This setting is same as function code H03.

 Refer to "0 Data Initialization" for details.

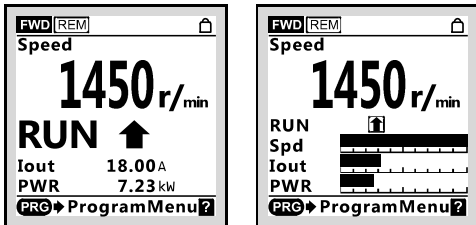
### 3.4.2.3 Display settings: Disp Setting”

PRG > 1 > 3 > 1 > **K15** to PRG > 1 > 3 > 13 > **K92**

Allows setting the keypad display content and behavior.

Follow the settings below to display output frequency, current, torque and other necessary information on the keypad's main monitor and sub-monitors.

Table 3.8 Items available in display settings

Sub-Menu		Functions	Function Code
1	Screen selection	Selects sub-monitor display (numerical display/bar graph) 	K15
2	Main monitor	Set main monitor display item.	<b>E43</b>
3	Select speed monitor	Set speed monitor <b>item that corresponding to E43 = 0.</b>	<b>E48</b>
4	Sub-monitor 1	Set sub-monitor 1 display item.	K16
5	sub-monitor 2	Set sub-monitor 2 display item.	K17
6	Bar graph 1	Set bar graph 1 display item.	K20
7	Bar graph 2	Set bar graph 2 display item.	K21
8	Bar graph 3	Set bar graph 3 display item.	K22
9	Backlight OFF time	Set backlight blackout time.	K02
10	Brightness control	Set backlight brightness.	K03
11	Contrast	Set contrast.	K04
12	Shortcut (◀)	Set shortcut destination for (◀) / (▶) key (jump <b>directly to registered menu screen from Running mode screen</b> ).	K91
13	Shortcut (▶)		K92

### 3.4.3 Function Codes

PRG > 2

Function code data settings and changes, including copying and initializing data, can be made via programming mode menu number 2, "Function Code".

#### 3.4.3.1 Setting up function code data: "Data Set"

PRG > 2 > 1

This section explains how to set function code data.

The examples below show how to change "F03: Rated speed" from 1450 r/min to 1800 r/min.

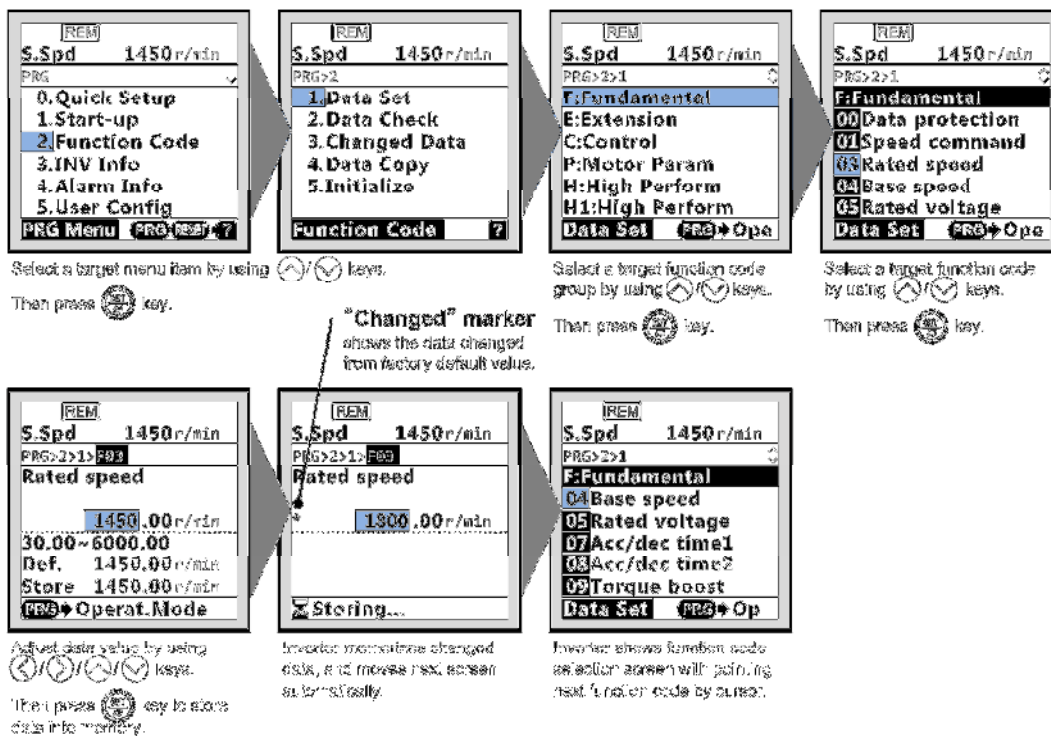


Figure 3.8 Screen transition example for setting function code

#### ■ Double-key operation

Some important function codes (for example, H03: Initialization) require double-key operation to prevent misoperation.

In order to change their data, press  $\text{STOP}$  key and  $\leftarrow$  key to increase, or  $\text{STOP}$  key and  $\rightarrow$  key to decrease.


#### ■ Changing function code data while running

Data for some function codes can be changed when the inverter is running; others cannot. Furthermore, for some function codes, changing the data will cause those values to be reflected immediately without storing in inverter operation; for other function codes, they will not be reflected.

For details on function codes, refer to the "2.2 Function Code Table" in Chapter 2.

### 3.4.3.2 Checking function code data: “Data Check”

PRG > 2 > 2

Function codes and function code data can be checked at the same time. Also, function codes that have been changed from their factory default values are accompanied by an asterisk (\*). Selecting the function code and pressing  key allows you to refer to or change the displayed function code data.

The Screen transition in this screen is almost same as in 3.4.3.1. However, the function code lost screen is as shown below.

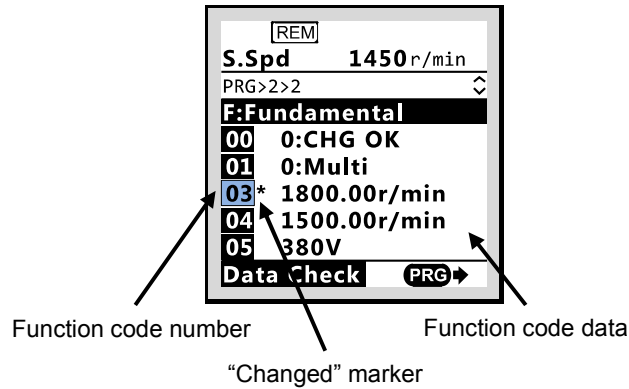



Figure 3.9 Checking function code data (display sample)

### 3.4.3.3 Checking changed function code data: Changed Data”

PRG > 2 > 3

Only function codes that have been changed from their factory default values are shown. Selecting the function code and pressing  key allows you to refer to or change the displayed function code data.

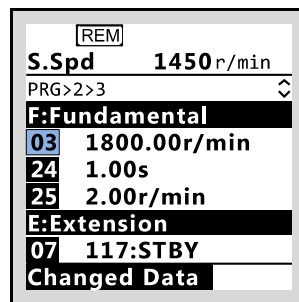


Figure 3.10 Checking changed function code data (display sample)



### 3.4.3.4 Copying function code data: Data Copy”

**PRG > 2 > 4**

This menu provides “Read”, “Write”, “Verify”, and “Check” operation, enabling the following applications. The keypad can hold three sets of function code data in its internal memory to use for three different inverters.

- (a) Reading function code data already configured in an inverter and then writing that function code data altogether into another inverter.
- (b) Copying the function code data saved in the inverter memory into the keypad memory for backup.
- (c) Saving function code data in the keypad as master data for data management; that is, saving more than one set of function code data in the keypad and writing a set of data suited to the machinery into the target inverter.

(a) Copy

(b) Backup

(c) Data management

The following functions can be made to sub-menu numbers 1 to 5.

Table 3.9 Operations available in copying function code data

Sub-Menu No	Sub-Menu	Description
1	I. Write: Write data with verification after initialization	Performs inverter initialization, data writing, and verifying automatically.
2	Read: Read data	Reads out function code data from the inverter memory and stores it into the keypad memory.
3	Write: Write data	Writes the data held in the selected area of the keypad memory into the target inverter memory.
4	Verify: Verify data	Verifies the data held in the keypad memory against that in the inverter memory.
5	Check: Check copied data in the keypad	Shows the model info (type) and function code data of three sets of data stored in the keypad memory.

The example below shows screen transition in the case of “I. Write” operation.

“Read”, “Write”, and “Verify” operations are similar.

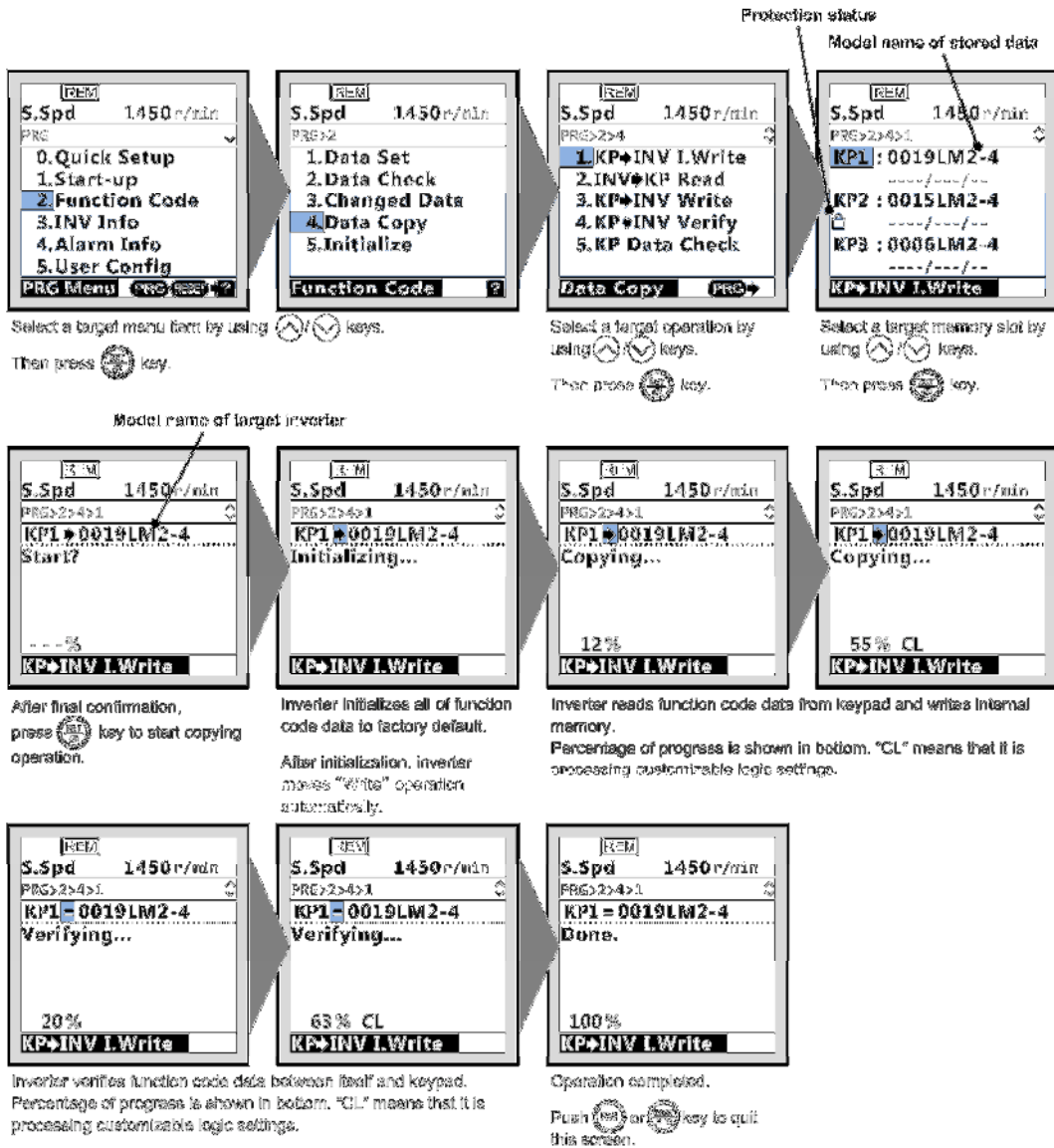


Figure 3.11 Screen transition example for copying function code data

In “Check” operation, function code data stored in keypad can be check on the screen as below.

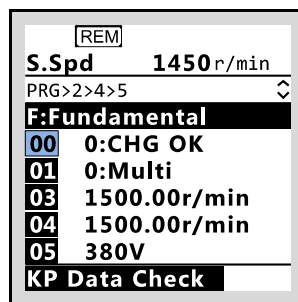



Figure 3.12 Checking function code data stored in keypad (display sample)

### ■ Overwritten protection for copied data

It allows protecting function code data stored in keypad for each memory slots.

In order to protect data, move to the screen for selecting target memory slot at “Read” operation (PRG > 2 .> 4 > 2), and move cursor to target memory slot that you want to protect.

Holding down the  key on the keypad for 5 seconds or more in above situation, toggles between protected and un-protected state for each memory slots individually.

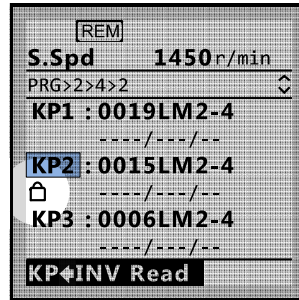
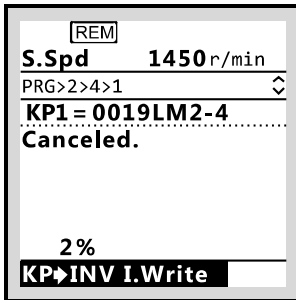


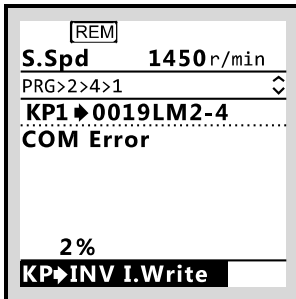
Figure 3.13 Overwritten protected status (display sample)

## ■ Error messages



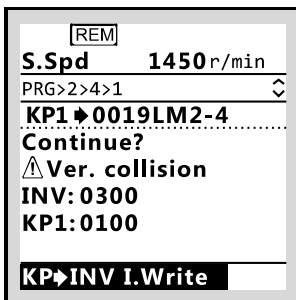
Pressing key or key during each operations cancel the operation, and "Canceled" is shown on the screen, and the operation is terminated forcibly.

In the case of "Read" operation, the data stored in the selected memory slot is cleared if cancelled.



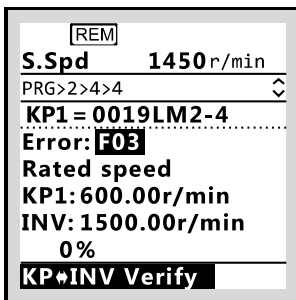
If a communication error occurs between keypad and inverter during each operations, the error screen will be displayed.

Try again after checking connections between keypad and inverter.



The function codes stored in the keypad are not compatible with the inverter function codes. (Version upgrades may be non-standard or incompatible. Please contact us.)

It can be continued by pressing key. In this case, it might cause problems because the operation is processed forcibly.



<Only "Verify" operation>

If there is a mismatch in the function code data between inverter and keypad, the mismatched function code data is displayed on the screen, and verification stops temporarily.

Pressing key again continues verification with the next function code data.



If an error screen is displayed, press the key or the key to release. After resetting, the screen returns to programming mode.

### 3.4.3.5 Initialize function code data: “Initialize”

PRG > 2 > 5





This returns function code data to the values in the factory default settings or sets function code data for certain application system. Changing the data requires double-key operation (the  key and the  key or the  key and the  key). The following types of initialization are available.

Table 3.10 Initialization types

Initialization type		Function
0	Manually set values	Does not initialize.
1	Initialize values to factory default values (vector control for IM)	Initialize all function code data to settings suited for vector control for IM. (initializes to factory default values).
2	System-specific initialization (vector control for PMSM)	Initialize all function code data to settings suited for vector control for PMSM.
3	System-specific initialization (open loop control for IM)	Initialize all function code data to settings suited for open loop control for IM.
11	Limited initialization (initialization except for communication function codes)	Initialize function codes except communication settings.
12	Limited initialization (initialization for customizable logic)	Initialize function codes for customizable logic U/U1 codes.

### 3.4.4 Inverter Information: “INV Info”

PRG > 3

Menu number 3, “INV Info” allows display of various information of the inverter: Current operation status, i/o status, and maintenance data.

Travel direction counter function is also provided in this menu.

#### 3.4.4.1 Check Operational Status: “Op Monitor”

PRG > 3 > 1

This allows to check the inverter’s operational status. This can be used when confirming operational status during maintenance or on test runs.

Table 3.11 Display items in “Op Monitor”

Page No.	Category	Code	Details
1	Reference speed (pre-ramp)	Fref	Reference speed (pre-ramp) currently specified [Hz]
	Reference speed (final)	Fout1	Reference speed (final) commanded to the Automatic Speed Regulator (ASR) [Hz]
	Output frequency	Fout2	Frequency being output [Hz]
	Motor rotational speed	SyncSp	Detected speed [r/min]
	Elevator speed	LiftSp	Detected speed [mm/s]
2	Output current	Iout	Output current value [A]
	Output voltage	Vout	Output voltage value [V]
	Calculated torque	Torque	Calculated torque [%] based on the motor rated torque being at 100%. *1
	Power consumption	Power	Power consumption [kW]

Page No.	Category	Code	Details
3	Output status	FWD	Rotating forward
		REV	Rotating reverse
		EXT	Inverter applies DC voltage to the motor
		INT	Inverter stops output
	Ramp status	Acc	During acceleration
		Dec	During deceleration
		Const	During constant speed
		<Blank>	Stopped
	Motor type	IM	Induction motor (asynchronous motor)
		PMSM	Permanent magnet synchronous motor
	Selected control mode	PG-IM	Vector control with PG for IM
		PG-PM	Vector control with PG for PMSM
		TV	Torque vector (open loop) control for IM
	Running status	PG/Hz	<input type="checkbox"/> : Enable vector control
		TrqLimit	<input type="checkbox"/> : During torque limitation
LowVolt		<input type="checkbox"/> : During low supply voltage	
4	Operational status	FAR	<input type="checkbox"/> : Frequency attained
		FDT	<input type="checkbox"/> : Frequency detection
		RDY	<input type="checkbox"/> : Ready to run
		FAN	<input type="checkbox"/> : Cooling fan operating
		TRY	<input type="checkbox"/> : Trying automatic resetting alarm
		OH	<input type="checkbox"/> : Overheat early warning
		LIFE	<input type="checkbox"/> : Lifetime warning
		ID	<input type="checkbox"/> : Current detection
		ID2	<input type="checkbox"/> : Current detection 2
5	Reference torque	TRQC	Value [%] based on the motor rated torque being at 100%.
	Reference torque current	TRQI	Value [%] based on the motor rated current being at 100%.
	Reference torque bias	TRQB	Value [%] based on the motor rated torque being at 100%.
	Electronic thermal for motor	OLM	Value [%] based on the electronic thermal overload protection being at 100%.
	Detected motor temperature	NTC	Detected motor temperature [°C]
6	CAN status	CAN Sta	Operational status
		CAN Bus	Error status
		CAN STM	State machine status
7, 8	Acceleration/Deceleration distance calculation Page 7: Acceleration distance Page 8: Deceleration distance	SpInit	Initial speed (before acceleration/deceleration) [mm/s]
		SpTrgt	Target speed (after acceleration/deceleration) [mm/s]
		Dist.	Calculated distance which takes during acc/dec [mm]
		Acc	Maximum acceleration rate [mm/s <sup>2</sup> ]
		Jerk1	1 <sup>st</sup> jerk [mm/s <sup>3</sup> ]
		Jerk2	2 <sup>nd</sup> jerk [mm/s <sup>3</sup> ]

\*1: In vector control with PG, this item shows the reference torque.

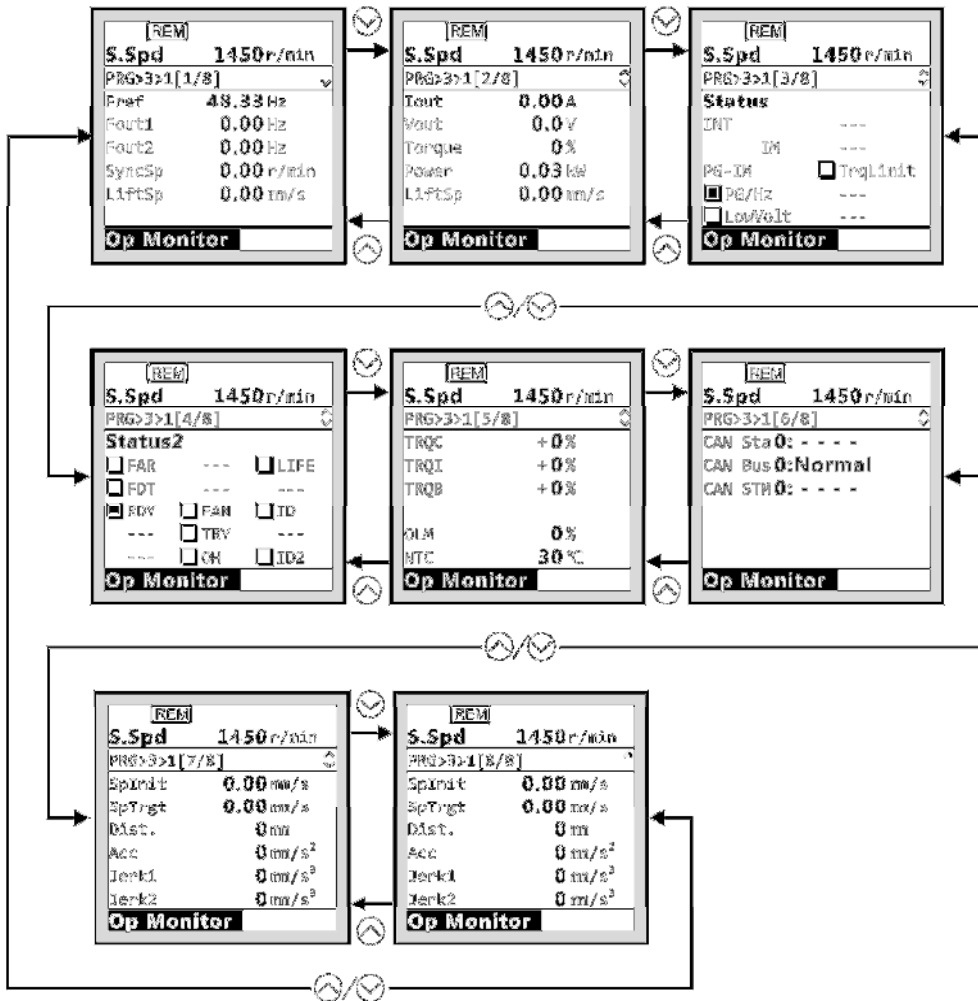


Figure 3.14 Screen transition for "Op Monitor" (display sample)

### 3.4.4.2 Check Status of Input/Output Signal Status: "I/O Check"

PRG > 3 > 2

This allows confirmation of the inverter's digital input/output signal and analog input/output signal. This can be used when confirming operational status during maintenance or on test runs.

Table 3.12 Display items in "I/O Check"

Page No.	Category	Category Details	Symbol	Details
1	Di	Control circuit terminal input signal (terminal input)	FWD, REV, X1-X8, EN1, EN2	ON/OFF information on control circuit's terminal input (Reversal on short-circuit, no reversal when open)
2	Di: Link	Communications port input signal	FWD, REV, X1-X8, XF, XR, RST	Input information on communication-specific function code S06 (Reversal on 1, no reversal on 0)
3	Do	Output signal	Y1-Y2, Y3A-Y5A, 30ABC	Output signal information
4	Ai/Ao	Analog input signal	12	Terminal 12 input voltage
			C1	Terminal C1 input current
			V2	Terminal V2 input voltage
			PTC	Terminal PTC input voltage
5	Theta	Phase angle	FM1-Vo	Terminal FMA output voltage, output current
			$\theta e$	Output electrical angle [deg-el]
			$\theta re$	Magnetic pole position detection angle [deg-mech] (Only displayed with PMPG option)
			$\theta m$	Detected mechanical angle[deg-mech]
6	Pulse	Encoder pulse	PPb	Magnetic pole position detection signal in binary (Only displayed with PMPG option)
			P2	Encoder pulse rate for A/B phase [kPulse/s]
			Z2	Encoder pulse rate for Z phase [Pulse/s]

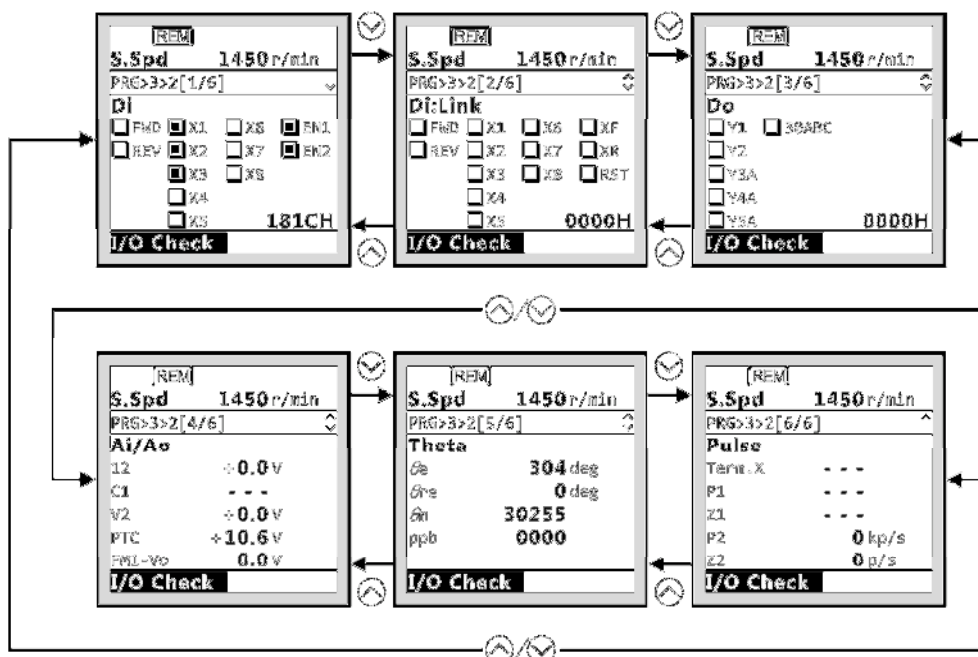


Figure 3.15 Screen transition for "I/O Check" (display sample)



### 3.4.4.3 View Maintenance Information: “Maintenance”

PRG > 3 > 3

Displays information needed for inverter maintenance.

Table 3.13 Display items in “Maintenance”

Page No.	Category	Code	Details
1	Cumulative run time	Time	Shows cumulative time inverter’s main power has been on. Reverts to 0 after exceeding 65,535 hours and begins counting up again.
	DC link bus voltage	Edc	Shows DC link bus voltage of inverter’s main circuit.
	Maximum effective current value	Imax	Shows as the effective value the maximum inverter output current each hour.
	Cumulative power level	Wh	Shows cumulative power level. Reverts to 0 after passing 1,000,000 kWh.
2	Number of starting motor (gate-on)	G-On	Shows the total amount of number the inverter has started the motor. The number is shown as 0.01 million.
	Number of power up	P-On	Shows the total amount of number the inverter has been turned power on. The number is shown as 0.01 million.
	Powered life of cooling fan	EneT	Shows the total amount of time the cooling fan has been in operation. Time when the cooling fan ON-OFF control (function code H06) is enabled and the cooling fan is off is not counted.
	Target life of cooling fan	Life	Shows the cooling fan’s remaining service life. Remaining life is calculated by subtracting elapsed time from the service life (five years).
3	Capacity of main circuit capacitor	Cap	Current capacity of main circuit capacitor is shown, using capacity at time of shipment as 100%.
	Life of electrolytic capacitor on PCB (Powered life)	EneT	Shows as cumulative run time the product of the cumulative amount of time during which a voltage has been applied to the electrolytic capacitor on the PCB times a coefficient to account for ambient temperature conditions.
	Target life of electrolytic capacitor on PCB	Life	Shows the remaining life of the electrolytic capacitor on the PCB. Remaining life is calculated by subtracting elapsed time from the service life (five years).
4	Cumulative motor run time	EneT	Shows the motor’s cumulative run time. Reverts to 0 after exceeding 99,990 hours and begins counting up again.
	Remaining time to motor maintenance	RemT	Shows the amount of time remaining until the next maintenance. The value shown is calculated by subtracting cumulative motor run time from the set maintenance time (H78).
5	Interior temperature (Real-time value)	Int	Shows the current temperature inside the inverter.
	Maximum interior temperature	Int(max)	Shows the maximum temperature inside the inverter in one-hour increments.
	Heat sink temperature (Real-time value)	Fin	Shows the current temperature of the heat sink inside the inverter.
	Maximum heat sink temperature	Fin(max)	Shows the current temperature of the heat sink inside the inverter.

Page No.	Category	Code	Details
6	RS-485 error (Communications port 1)	Ch1	Shows the cumulative number of times an error has arisen at RS-485 (communications port 1) and the code for the most recent error.
	RS-485 error (Communications port 2)	Ch2	Shows the cumulative number of times an error has arisen at RS-485 (communications port 2) and the code for the most recent error.
	Option error (A-port)	OpA	Shows the cumulative number of times an error has arisen in option communications when loading the option (A-port) and the code for the most recent error.
	Option error (B-port)	OpB	Not supported.
	Option error (C-port)	OpC	Shows the cumulative number of times an error has arisen in option communications when loading the option (C-port) and the code for the most recent error.
7	CAN communication error	SD Er	Shows the cumulative number of times a transmitting error has arisen at CAN communication.
		RD Er	Shows the cumulative number of times a receiving error has arisen at CAN communication.
8	Inverter ROM version	Main	Shows the inverter ROM version as four digits.
	Keypad ROM version	KP	Shows the keypad ROM version as four digits.
	Option (A-port) ROM version	OpA	Shows the option (A-port) ROM version as four digits.
	Option (B-port) ROM version	OpB	Not supported.
	Option (C-port) ROM version	OpC	Shows the option (B-port) ROM version as four digits.
9	Option (A-port) Type	OpA	Shows the option (A-port) name of type.
	Option (B-port) Type	OpB	Not supported.
	Option (C-port) Type	OpC	Shows the option (C-port) name of type.

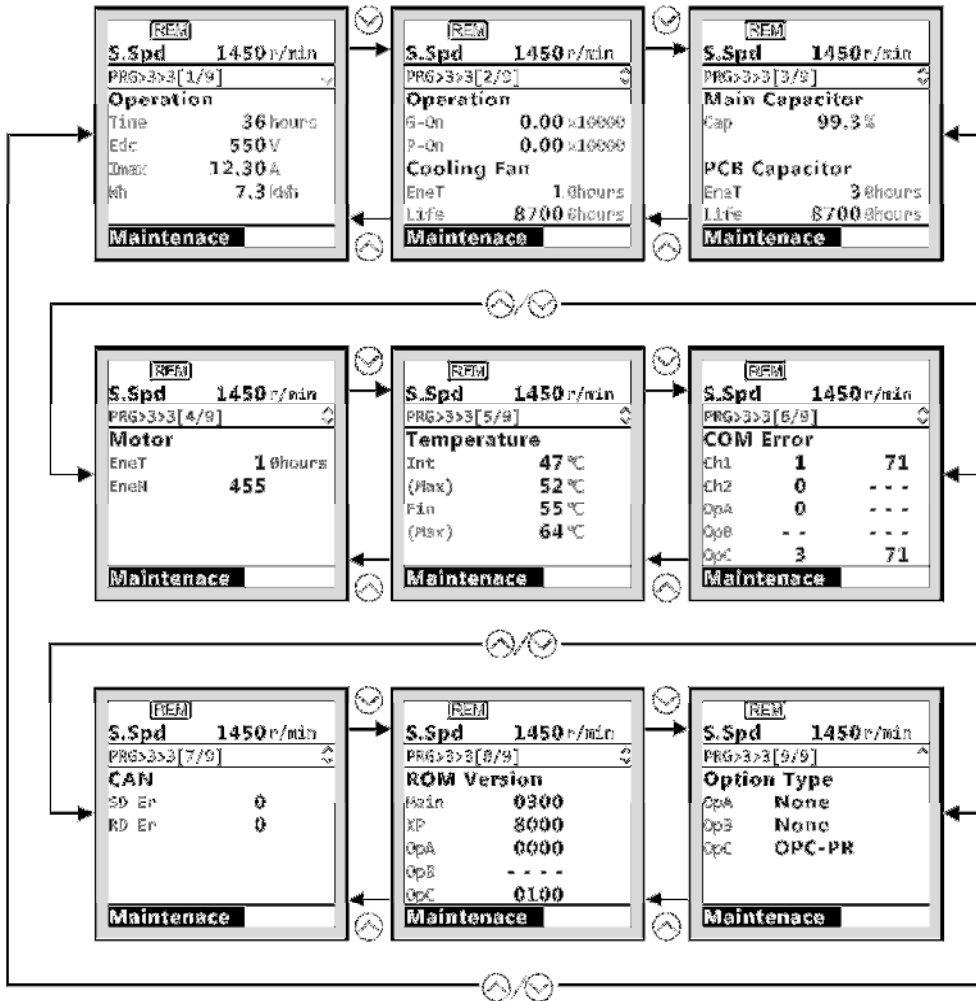


Figure 3.16 Screen transition for "Maintenance" (display sample)

### 3.4.4.4 View Unit Information: "Unit Info"

PRG > 3 > 4

Shows inverter type, serial number and ROM version.

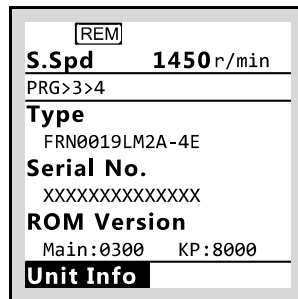


Figure 3.17 Unit information screen (display sample)

### 3.4.4.5 Check/Set travel direction counter function: “Travel Counter”

PRG > 3 > 5

This allows to check and set the travel direction counter (TDC) function.

For additional information about TDC function, refer to related Application Note (AN-Lift2-0004v100EN).

### 3.4.5 Alarm Information: “Alarm Info”

PRG > 4

#### 3.4.5.1 Check Alarm History: “Alarm History”

PRG > 4 > 1

For the most recent alarm and the past three, shows alarm codes indicating the types of protective functions operated, the number of consecutive alarms, and the various inverter status at the time the alarm was triggered.

Table 3.14 Display items in “Alarm History”

Page No.	Category	Symbol	Details
1	Alarm name	—	Name of alarm
	Main alarm	Main	Triggered alarm code and alarm sub-code which means detailed causes of alarm. For detail about alarm sub-code, please contact us.
	Overlapping alarm 1	O.lap1	Simultaneously triggered alarm code (No. 1) and alarm sub-code. (If no alarm, shows " --- ")
	Overlapping alarm 2	O.lap2	Simultaneously triggered alarm code (No. 2) (If no alarm, shows " --- ")
2	Reference speed (pre-ramp)	Fref	Reference speed (pre-ramp) currently specified [Hz]
	Reference speed (final)	Fout1	Reference speed (final) commanded to the Automatic Speed Regulator (ASR) [Hz]
	Speed	Speed	Detected speed [Hz]
	Output current	Iout	Output current [A]
	Output voltage	Vout	Output voltage [V]
	Magnetic pole position offset angle	PP.Ofs	Magnetic pole position offset angle [deg] at that time.
3	Calculated torque	Torque	Calculated torque [%]
	Reference torque	TRQC	Value [%] based on the motor rated torque being at 100%.
	Reference torque current	TRQI	Value [%] based on the motor rated current being at 100%.
4	Cumulative run time	Time	Shows cumulative time inverter’s main power has been on. Reverts to 0 after exceeding 655,350 hours and begins counting up again.
	Number of startups	EneN	Accumulates and shows the number of motor operations (the number of times the inverter run command has been ON). Reverts to 0 after exceeding 6,553,500 times and begins counting up again.
	DC link bus voltage	Edc	Shows DC link bus voltage of inverter’s main circuit.
	Interior temperature	T.Int	Shows the interior temperature.
	Heat sink temperature	T.Fin	Shows the heat sink temperature.
	Power consumption	Power	Power consumption (only the most recent alarm history stored.)

Page No.	Category	Symbol	Details
5	Output status	FWD	Rotating forward
		REV	Rotating reverse
		EXT	Inverter applies DC voltage to the motor
		INT	Inverter stops output
	Ramp status	Acc	During acceleration
		Dec	During deceleration
		Const	During constant speed
		<Blank>	Stopped
	Motor type	IM	Induction motor (asynchronous motor)
		PMSM	Permanent magnet synchronous motor
	Selected control mode	PG-IM	Vector control with PG for IM
		PG-PM	Vector control with PG for PMSM
		TV	Torque vector (open loop) control for IM
	Running status	PG/Hz	<input type="checkbox"/> : Enable vector control
TrqLimit		<input type="checkbox"/> : During torque limitation	
LowVolt		<input type="checkbox"/> : During low supply voltage	
6	Operational status	FAR	<input type="checkbox"/> : Frequency attained
	Frequency detection	FDT	<input type="checkbox"/> : Frequency detection
	Run preparation	RDY	<input type="checkbox"/> : Ready to run
	Recovering power after momentary power failure	FAN	<input type="checkbox"/> : Cooling fan operating
	Motor overload	TRY	<input type="checkbox"/> : Trying automatic resetting alarm
	Fan operating	OH	<input type="checkbox"/> : Overheat early warning
	Retrying	LIFE	<input type="checkbox"/> : Lifetime warning
	Heat sink overheat early warning	ID	<input type="checkbox"/> : Current detection
	Lifetime alarm	ID2	<input type="checkbox"/> : Current detection 2
	Overload prevention controlled	OLP	Overload prevention controlled
	Current detection	ID	Current detection
7	Di: Control circuit terminal input signal (terminal input)	FWD, REV, X1-X8, EN1, EN2	ON/OFF information on control circuit's terminal input (Reversal on short-circuit, no reversal when open)
8	Di Link: Communications port input signal	FWD, REV, X1-X8, XF, XR, RST	Input information on communication-specific function code S06 (Reversal on 1, no reversal on 0)
9	Do: Output signal	Y1-Y2, Y3A-Y5A, 30ABC	Output signal information

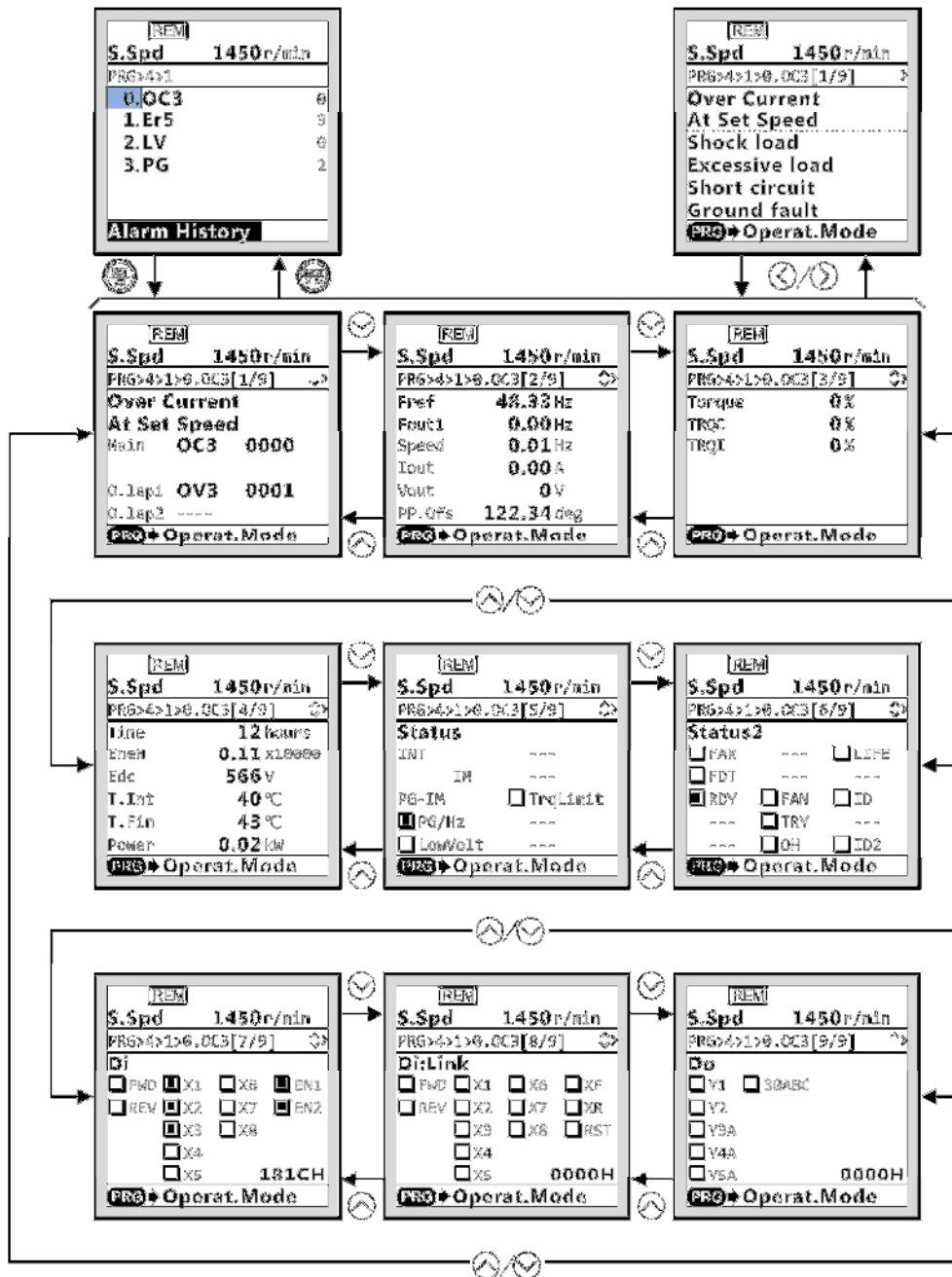


Figure 3.18 Screen transition for "Alarm History" (display sample)

### 3.4.6 User Configuration: "User Config"

PRG > 5

#### 3.4.6.1 Quick setup

PRG > 5 > 1

From programming mode menu number 5, "User Config" function codes can be added to or deleted from the Quick Setup. Target function codes can be added or deleted by selecting them.

### 3.4.7 Tools

PRG > 6

#### 3.4.7.1 Monitor Customizable Logic: “CLogic Monitor”

PRG > 6 > 1

Customizable logic can be previewed graphically in each function block.

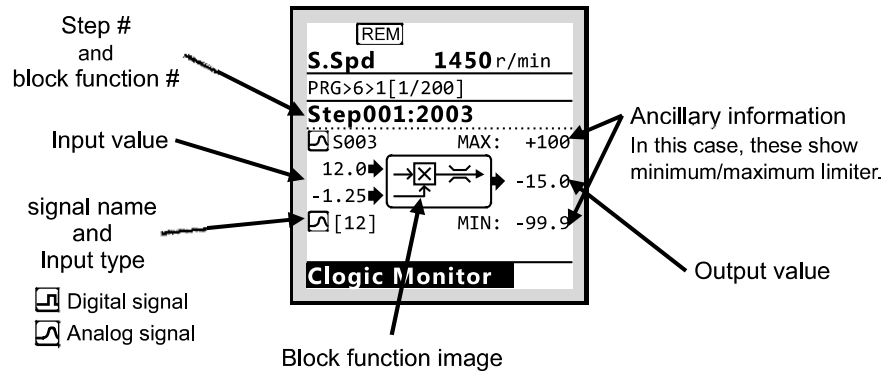


Figure 3.19 Customizable logic monitor (display sample)

#### 3.4.7.2 Load Factor Measurement: “Load Factor”

PRG > 6 > 2

This function enables measurement of the maximum output current, average output current and average braking power. Measurement modes are indicated in the table below.

Measurement Mode	Details
Mode for measuring for a fixed period of time	Mode for setting a measurement period and taking measurements for a set period of time
Mode for measuring from run to stop	Mode for taking measurements from the beginning to the end of a run

**Note** If in the mode to measure the interval from run to stop, entering this mode while running will take measurements during the period until stopping. If entering this mode while stopped, measurements will be taken from the next run until the stop.

**Tip** During load factor measurement, the **PRG** key transitions into running mode. The **RESET** key moves to the measurement mode selection screen. In this case, load factor measurement will be continued.

#### 3.4.7.3 Communication Debug: “COM Debug”

PRG > 6 > 3



Communication-specific function codes (S, M, W, W1, W2, W3, X, Z) can be monitored and set.

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## 3.5 Alarm Mode

If an abnormal condition arises, the protective function is invoked and issues an alarm, then the inverter automatically enters Alarm mode. At the same time, an alarm code appears on the LCD monitor.


### 3.5.1 Releasing the alarm and switching to Running mode



Remove the cause of the alarm and press the  key to release the alarm and return to Running mode. The alarm can be removed using the  key only when the alarm code is displayed.


### 3.5.2 Displaying the alarm history

It is possible to display **4** alarm codes (newest + past **3** alarms) in addition to the one currently displayed. Previous alarm codes can be displayed by pressing the  /  key while the current alarm code is displayed.

### 3.5.3 Displaying the status of inverter at the time of alarm

When the alarm code is displayed, you may check various running status information (output frequency and output current, etc.) by pressing the  key.

Further, you can view various pieces of information on the running status of the inverter using the  /  key. The information displayed is the same as for Menu #4 “Alarm Information” in Programming mode. Refer to **Section 3.4.5.1**, “Confirm Alarm History.”

Pressing the  key while the running status information is displayed returns to the alarm code display.



# FRENIC-Lift

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## Reference Manual

First Edition, April 2015

Fuji Electric Co., Ltd.

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The purpose of this instruction manual is to provide accurate information in handling, setting up and operating of the FRENIC-Lift (LM2) series of inverters. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

In no event will Fuji Electric Co., Ltd. be liable for any direct or indirect damages resulting from the application of the information in this manual.

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